

**AN EXPERIMENTAL STUDY OF SIGNIFICANCE
OF PERITONEAL CLOSURE AT
LAPAROTOMY**

**THESIS
FOR
MASTER OF SURGERY
(GENERAL SURGERY)**



**BUNDELKHAND UNIVERSITY
JHANSI (U. P.)**




SUNIL KUMAR GUPTA

Department of Surgery,
M.L.B. Medical College,
Jhansi.

C E R T I F I C A T E

This is to certify that the work of
Dr. Sunil Kumar Gupta on " AN EXPERIMENTAL STUDY OF
SIGNIFICANCE OF PERITONEAL CLOSURE AT LAPAROTOMY "
which is being presented by him as a thesis for
M.S.(General Surgery) examination, was conducted
in the department of Surgery under my direct
supervision and guidance.

He has put in the necessary stay in
the department as per university regulations.


(S. L. AGARWAL)
M.S., F.R.C.S.
Prof. & Head of Surgery Deptt.
M.L.B. Medical College,
JHANSI.

Date: 14-5-83

Department of Pathology,
M.L.B. Medical College,
Jhansi.

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(V. P. MITTAL)

M.D.(Pathology)

Prof. & Head of Pathology Deptt.
M.L.B. Medical College, JHANSI.

Date: 28 5 83

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(SUNIL KUMAR GUPTA)

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INTRODUCTION

INTRODUCTION

Abdomen, the magic box, a riddle to the surgeon is more often subjected to surgery than any other body part. Hence there are many methods of opening and closing the abdomen. It is probably no exaggeration to state that in abdominal surgery wisely chosen incisions and correct methods of making and closing such wounds are factors of paramount importance. Any mistake here such as a badly placed incision a careless disregard of motor nerves that supply the abdominal muscles, inept methods of suturing, an ill judged selection of suture material may result in serious immediate or later complication such as haematoma formation, infection by pyogenic organisms, disruption of the wound, stitches abscess, a weakened scar, an ugly raised keloid or a tell tale rupture.

Very many of the operations performed by the average general surgeon with in the abdomen and consequently incision and suture of the abdominal parietes is one of the commonest exercises in operative surgery. A considerable number of different suture techniques exist for closure of such laparotomy wounds and each has its strong supporters. However when attempts are made to compare objectively the relative merits of some of these

methods in ordinary clinical practice, difficulties are apt to be encountered because of many other variable factors such as age, sex, physique and general condition of the patient and nature of the lesion being treated which may conceivably influence the outcome in an individual case. Unquestionably the value of all too many clinical reports on the relative advantage of different suture methods has been reduced because of inadequate control of these possible sources of bias.

The technique of closure of abdominal wounds, like much of surgery has tended to develop as a practical, experimental matter rather than on the basis of hypothesis which lead either to experimental test in clinical practice and laboratory or to theoretical evaluation based upon mathematical or other understanding. When such is the case practice tends to be reinforced by dogma, in that no one can easily demonstrate the superiority of one method over another. Such demonstration is likely to take place when (a) it has been ascertained if the problem is in fact analysable and (b) the appropriate models can be designed to test the validity of the hypothesis based upon such analysis. A prerequisite of both is to make some valued judgement about the importance of investigating the problem.

Most surgeons believe that the peritoneum must be sutured in the closure of an abdominal incision. A dozen current standard English and American text books of operative surgery stress the importance of this manoeuvre. Yet we know from clinical observation and from animal studies that raw peritoneal defects heal rapidly (Ellis 1962). We know that in fat, straining patient with poor tissue peritoneal stitches often tear through as fast as they are inserted with no obvious later deleterious effects, and we know that some surgeons heretically fail to observe the rules and leave the peritoneum unsutured without apparent disaster.

Undoubtedly the question is of some importance. If leaving the peritoneum open makes no difference to healing of the abdominal wound then an unnecessary routine could well be given up and the occasional considerable difficulty in obtaining peritoneal closure avoided. If in contrast it were to be shown that there is a higher incidence of wound failure, when the peritoneum is not sutured, then this procedure must obviously retain it's present sacred role in laparotomy closure.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Abdomen is a magic box, enclosed by the abdominal walls and is completely filled by the abdominal viscera. The kidneys and suprarenal glands lie on the posterior abdominal wall enclosed in fascial lining while anterior to these are the other structures surrounded to a greater or lesser extent by the peritoneal cavity.

PERITONEAL CAVITY

The peritoneal cavity is of course a coelom a discontinuity in the mesoderm with its own special surface epithelium which maintains the surface.

The peritoneum is the largest and most complexly arranged serous membrane in the body and consists in male a closed sac, a part of which lines the abdominal wall, whilst the remainder is reflected over the contained viscera. In the female the free ends of the uterine tubes open into peritoneal cavity. The part which lines the abdominal wall is named parietal peritoneum; that which reflects over the contained viscera constitutes visceral peritoneum. The free surface of the membrane is smooth covered with a layer of flattened mesothelium and kept moist by a small quantity of serous fluid. Hence the viscera can glide on the wall of cavity

or on one another.

HISTOLOGY

The peritoneum consists of a single layer of flattened mesothelial cells which covers a layer of loose connective tissue. Adjacent mesothelial cells are joined by junctional complexes, which probably allow the passage of macrophages to or from the underlying connective tissue. The sub mesothelial connective tissue carries macrophages, lymphocytes and adipose cells. It has been claimed that mesothelial cells can transform into macrophages and fibroblasts.

From the earlier days of abdominal surgery, surgeons were compulsive about reperitonizing abdominal wall and viscera to restore the normal anatomy even if this entails the use of significant amount of foreign body materials. Often resulting in tension and ischaemia.

The average general surgeon without giving the matter much thought assumes that the defects in the peritoneum heal from edges as does skin. If this were so large peritoneal defects would heal slowly and probably with many adhesions.

How-ever all reported investigation contradict these assumptions. It has been shown that peritoneum regenerates de novo and not from the cut edges of a defect.

Microscopic studies suggest that the new peritoneal cells are derived from mesodermal cells of the underlying granulation tissue. Mesenchymal cells being multipotent able to take form of fibroblasts or mesothelial cells depending upon environment.

Lewis in 1923 wrote that such mesothelial cells seem to differ from mesenchymal cells only in form and not in structure indicating that mesothelium is to be considered not as a tissue differentiated from mesenchyme but merely as a change or transformation in form.

PATHOPHYSIOLOGY OF PERITONEAL HEALING

Detailed study of healing of peritoneum have been done which reflects the following results according to duration of healing.

Results : as observed microscopically.

At 24 hours

At 24 hours the peritoneal defect were covered by a thin layer of fibrin infiltrated by various degrees with polymorphonuclear cells, eosinophils, lymphocytes, monocytes and histiocytes. The phagocytosis of injured muscle fibres in the depth of wound was evident.

At 48 hours

At 48 hours the picture was essentially the same except for the presence of an occasional fibroblasts.

A few mononuclear cells were occasionally seen lining up on the surface of the fibrin. However this appeared to be random phenomenon. Phagocytosis results in fewer adhesions than a closed one.

At 3 days

At 3 days a marked change had occurred. Most inflammatory cells had disappeared except for a few macrophages. The fibrin layer was almost completely replaced by younger fibroblasts. On the surface the later were arranged in a smooth continuous layer. Mitotic figures were numerous.

At 4-6 days

From 4-6 days the cells lining the surface become less rounded and indistinguishable from normal peritoneum. The underlying fibroblastic tissue became less cellular as collagen was formed. During the period of observation all the above changes occurred through out defect simultaneously.

Following studies reflect the mechanism of healing of peritoneum.

Von DeBowski in 1888 and Franz in 1902 showed that defects in the parietal peritoneum of dogs would heal without adhesions.

Hertzler in 1919 showed that when a defect was made in the perietal peritoneum of animals the entire surface becomes endothelialized simultaneously and not gradually from border as in epidermitization of skin wounds. Ellis 1962, Bridges 1964 and others subsequently confirmed his findings regarding the perietal peritoneum visceral peritoneum regenerates in similar manner as shown by Glusksman in 1966.

Work of von Debow ski (1888) was largely ignored over the years until Robbins, Brunschwig and foote in 1949 confirmed it in the dog and in man showing that peritoneal regeneration was rapid and adhesions minimal when wide areas of the abdominal parietes were left denuded of peritoneum.

The peritoneal defects become covered by mesothelium in a few days regardless of size has been demonstrated in dogs, rats and rabbits. That a similar manner of regeneration does not exists in the human is unlikely. Although the intact peritoneum at the edges of a defect play a minor role in this new covering it is evident that the new peritonsum comes predominantly from underlying mesodermal cells.

Thus large defects heal as rapidly as small ones and microscopically all parts of a defect show the same degree of reperitonealization.

PERITONEAL ADHESIONS

From earlier days of abdominal surgery, surgeons became familiar with fibrinous adhesions that develop within a few hours of operational trauma. This fibrin can either be reabsorbed completely, leaving a clear peritoneal cavity or become organized by the in-growth of fibroblasts to form established fibrous adhesions. It was soon apparent that the important thing to determine is the factor that decides whether the adhesions are to be absorbed completely or become organized into fibrous strands. Surgeons and pathologists by their arm chair reasoning assumed that this factor was whether or not peritoneal endothelium was intact. This led to the principle that peritoneal injury must be avoided at all costs, that raw damaged serosal surfaces must be eliminated within the peritoneal cavity and that peritoneal defects must be over sewn. But when arm chair theory was put to test results were different. It is now well established that peritoneal defects left open and bleeding heal within a few days into a smooth glistening new serosa.

Buchman et al have shown that peritoneal defects have a high plasminogen activity measured by the area of lysis produced on fibrin plates. This explains the failure of intact peritoneum to lyse fibrinous adhesions to adjacent ischaemic tissue.

Robbin et al in 1949 reported in number of patients in whom large areas of parietal peritoneum had been sacrificed during radical operations for cancer in whom reperitonealization had been impossible. No instance of obstruction occurred and at later reoperation there was a smooth glistening peritoneal surface.

Thomas and Rhoads in 1950 demonstrated that a defect in the visceral peritoneum of rats and guinea pigs produced adhesions in 79% of instances if ever sewn with fine silk and only in 31.9% if left open.

In 1952 Rini and Zollinger showed that extensive denuding of visceral peritoneum of the small bowel in dogs was followed by no unfavourable sequelae.

Singleton et al (1952) found that 1.00 centimeter square defects in visceral peritoneum healed with fewer adhesions than if closed by peritoneal graft suture or plication. Large defects of parietal peritoneum also healed with fewer adhesions than did the abdominal incisions which had been sutured.

Trimpi and Bacon in 1952 reported 46 cases of abdomino periheal resection of the rectum, in 18 patients the peritoneal floor was closed and there were 4 instances of intestinal obstruction. In 28 patients no reperitonealization was done and there were no instances of obstruction.

As a corollary ulfelder and Guinby 1951 found that after combined abdomino perineal resection 50% of post operative intestinal obstruction were due to in car-ceration of small bowel between sutures of the newly constructed peritoneal floor.

Williams in 1955 stated that he had not peritonealized the gall bladder bed for 13 years and had never reperitonealized after colectomy with no cause of regret.

Ellis in 1962 made defects measuring 1.00 to 3.00 centimeter in diameter in the perietal peritoneum of rats. Of 58 such defects 53 healed without adhesions. In 19 rats he repaired similar defects with fine silk and of these 16 developed adhesions.

Ellis 1962 believed these adhesions were due to the trauma of suturing under tension rather than to a foreign body reaction to silk.

R.C. Karipineni 1976 reported in his series that cases in which fascia and peritoneum were closed (Group A) moderate adhesions developed in two and severe adhesions in seven. Of group B with only fascia was closed moderate adhesions developed in six and severe adhesions in three.

INCISIONAL HERNIA

Hernias imply defects in the musculo fascial planes and therefore by definition, efficient fascial healing is sufficient to prevent the occurrence of hernia. For optimal fascial healing good approximation of the fascia is essential.

R.C. Karipineni reported in his series that in the dogs in which fascia and peritoneum were closed (Group A) three had no weakness or hernia, and three had hernias develop. Of the dogs in which fascia only was closed, (Group B) Six had no weakness or hernia and two had weakness and in one hernia developed.

Similar worker also measured the tensile strength in pounds at 3 weeks, six weeks and six months in Group A fascia and peritoneum were 26, 25 and 31 and in group B fascia only were 31, 34 and 35 respectively.

Harold Ellis and Robert Heddle in 1977

randomized the closure of vertical laparotomy wounds into a two layer technique of continuous catgut to peritoneum and continuous nylon to sheath and a one layer technique in which the peritoneal suture line was omitted. In 162 two layer closures there were 4 burst abdomen and 7 hernias 6.8% wound failure; in 164 one layer closure there were 5 burst abdomen and 7 hernias 7.3% wound failure. This difference is statistically not significant. Same workers also worked on animals on similar lines and found that there was no significant difference between tensiometric findings of healing incision or incidence of adhesions in the two groups. The histological appearance were similar with one and two layer closure.

MATERIAL AND METHOD

M A T E R I A L A N D M E T H O D

This study was conducted in experimental laboratory of M.L.B. Medical College, Jhansi from May, 1982 to April, 1983.

Twenty seven mongeral dogs were procured from animal house of M.L.B. Medical College as experimental animal for laparotomy.

METHOD OF STUDY

Pre-operative assesment

All animals were adult male of body weight ranging from six kilogram to eight kilogram. They were fed on standard diet and all were taking diet normally with normal bowel function.

The animals were given scrub bath a day before the operation for hygiene. They were given nothing by mouth a day before the operation. No antibiotic or any other drug was given in pre-operative period.

Operation Notes

Anaesthesia

For anaesthetizing the animals Pentobarbital sodium was used. Pentobarbital sodium is a short acting barbiturate whose plasma life is fifteen to fourty eight hours. This was given in the doses of thirty milligram

per kilogram body weight intravenously. This was used for induction as well as maintenance of anaesthesia. No other medicament was given along with pentobarbital sodium. This anaesthetic agent provided us adequate anaesthesia, analgesia and muscle relaxation without depressing the respiration during operation.

STEPS

After anaesthetizing the animal it was put over operation table and all the four limbs were tied with the corners of the table. Abdomen was shaved, painted with savlon and spirit and drapped with sterile sheets.

To keep the uniformity a three inch long incision was made in the skin parallel to midline on right side and at a distance of two centimeter from it. The anterior rectus sheath is divided in a line of the skin incision. Artery forceps were placed on the medial cut margin of anterior rectus sheath which is retracted to expose the medial edge of the rectus muscle. The rectus muscle is displaced laterally to expose posterior rectus sheath. The posterior rectus sheath is incised in the line of skin incision, together with transversalis fascia and peritoneum.

TECHNIQUE OF CLOSURE

Animals were randomized into two groups depending upon the technique of closure of abdominal (laparotomy) wound.

GROUP A TWO LAYERS CLOSURE (Conventional Method)-

In this group of animals during closure of laparotomy wound parietal peritoneum with posterior rectus sheath was sutured with 2/0 continuous chromic catgut on eyeless needle. The anterior rectus sheath was closed with continuous 2/0 chromic catgut on cutting needle. Skin was approximated with interrupted linen suture.

GROUP B SINGLE LAYER CLOSURE (Peritoneum left open)

In this group parietal peritoneum of experimental animal was not sutured. It was left open. Only anterior rectus sheath was closed with 2/0 continuous chromic catgut on cutting needle. Skin was approximated by interrupted linen suture.

After closing the laparotomy wound in both groups of animals stitch line was cleaned with savlon and spirit. Stitch line was sealed with Healex spray and no dressing was done of stitch line.

Time consumed in both groups of technique from skin incision to skin closure was noted.

Post Operative Period

The animals recovered from effect of anaesthesia within thirty minutes to forty five minutes. Their respiration was regular and corneal reflex was present. Animals were not given any thing by mouth that day though bowel sounds were present in the evening. From next day they were fed on standard diet throughout the period of follow up. All animals were taking diet normally with normal bowel action & other body activities. No antibiotic or any other drug was given post operatively.

The animals were watched, twice a day. For their general condition and stitch line for sepsis, haematoma formation etc. Skin stitches were removed on Eighth post operative day in all animals.

Re-opening of Abdomen

Seven animals of two layer group & six animals of one layer group were selected at random basis. They were sacrificed on tenth post-operative day. In these animals abdomen was reopened after adequate preparation by muscle cutting vertical incision which was one inch lateral to first incision. Skin, muscles and peritoneum were cut in one line. Though this incision abdominal

cavity was inspected for adhesion of peritoneum with intestine. Appearance of parietal peritoneum along the first incision line was observed.

Measurement of tensile strength of healing incision

Following sacrifice of animals on tenth post-operative day and after observing the peritoneal cavity for adhesions, the tensile strength of healing incision was studied as follows. Skin and subcutaneous tissue were dissected free and discarded and a block of abdominal wall including incision line was excised. This specimen was then divided into three transverse strips of one inch each containing one inch portion of incision line. One strip from each animal was set aside for histologic study. Tensile strength of the remaining two strips were then tested using a tensiometer.

Tensiometer

Tensiometer was designed and built in our laboratory. The instrument consists of a wooden board. At one end of this wooden board there was attached a frictionless pulley. There were two clamps in the instrument one clamp was fixed to another end of wooden board. Second clamp was mobile which was connected by means of a wire passing over the pulley to a bucket in which weights were added at a steady rate.

Method of measurement

Each strip of abdominal wall tissue was fixed between two clamps with the healing incision in the midline. Weights were added with a rate of hundred gram every ten seconds and the point at which it breaks was taken as the tensile strength.

HISTOLOGICAL STUDY OF ABDOMINAL WALL TISSUE

For histological study of abdominal wall tissue strip of abdominal wall tissue was collected in formaline vial and taken to pathology department for histological section, slide formation and study.

Preparation of histological section (Processing)

Section was processed in following steps.

Fixation:-

Fixation of tissue was done in formaline to preserve normal structure of tissue.

Dehydration:-

Tissue was treated with increased concentration of alcohol for twelve to twenty four hours to abolish the water content of tissue.

Clearing:-

Clearing of tissue was done to remove the alcohol by chloroform.

Impregnation:-

Impregnation of tissue was done with wax at fifty four to fifty six degree centigrade temperature. This whole process took approximately twenty four hours.

Castings:- Impregnated tissue was taken out and put in 'L' blocks for casting.

Section cutting

Sections of tissue of five to eight thickness were cut by microtome.

Now section was put in water bath at fifty eight degree centigrade temperature and lifted over a albumin coated slide.

Staining

For staining Haematoxylin and eosin dye were used.

Preliminary treatment

Hydration of tissue was done by using descending grades of alcohol.

Now section was put in haematoxylin for three to five minutes and differentiation was done with one percent acid alcohol. Section was washed in running water. Counter stain with one percent eosin for one minute was done. Section was again dehydrated using increasing concentration of alcohol.

Alcohol was cleared with xylol and mounted in 'BPX'.

Study

Now it was studied under low & high powers of microscope and photographs were taken.

Follow up

In rest of the animals of both group who were not sacrificed on tenth day to seen adhesions and to measure tensile strength were followed for 3 months post operatively. They were watched daily for late post operative abdominal complications like incisional hernia, obstruction etc.

OBSERVATION

OBSERVATIONS

This study comprises of twenty seven mongerel dogs procured from animal house of M.L.B. Medical College, Jhansi.

Table No. 1

Showing number of animal undergoing

- (1) Two layer closure and
- (2) ~~One~~ Two layer closure of laparotomy wound.

Group	Number of animals	Percentage
Two layer closure	14	51.8
One layer closure	13	48.1

Out of twenty seven animals studied abdomen in fourteen animal (51.8%) was closed in two layers (Peritoneum sutured) and in thirteen (48.1%) abdomen was closed in one layer (Peritoneum not sutured).

Table No. 2

Showing average time consumed in
two groups from skin incision to skin closure.

Group	Average time in minutes
Two layer closure	22
One layer closure	16

The average time consumed in two
layer closure was twenty two minutes while in
one layer closure was sixteen minutes. This clearly
reflects that enough operation time can be reduced
by leaving the peritoneum unsutured.

Table No. 3

Showing incidence of early post operative wound complications in two groups of animals.

Group	No. of animal	Complications			
		Suture Haematoma	Suture Sepsis	Burst Abdomen	Others
Two layer closure	14	3	2	1	Nil
One layer closure	13	1	1	Nil	Nil

Thus out of fourteen animals of two layer closure in three animals suture haematoma and in two animals suture sepsis developed. In one animal of this group Burst abdomen occurred. In one layer closure one animal developed suture haematoma and in one animal suture sepsis.

Table No. 4

Showing incidence of adhesions formation in two groups of animals which were sacrificed on tenth day.

Group	No. of animals sacrificed	Adhesions	Percentage
Two layer closure	7	4	57.1
One layer closure	6	2	33.33

Out of seven animals of two layer group who were sacrificed four animals (57.1%) developed adhesions of small intestine with parietal peritoneum. In one layer group out of six animals two animals (33.33%) developed adhesions. This clearly showed that incidence of adhesions formation was significantly low in animals of one layer group in whom peritoneum was not closed.

Naked Eye appearance of peritoneum and its microscopic picture

Naked eye appearance and microscopic picture of peritoneum was studied in the animals who did not develop adhesions i.e. in three animals of two layer

group and four animals of one layer group peritoneum was found smooth & glistening. The appearance was similar in both groups. The site where peritoneum was cut could not be identified. This reflects that peritoneum heals even without need of approximating its edges.

Histological reports of peritoneum was similar in both groups. In both groups was resembling normal histology of peritoneum i.e. single layer of mesothelial cells covering a layer of loose connective tissue.

Table No. 5

Showing weight in grams required to separate healing incision (tensile strength).

<u>Two layer closure</u>		<u>One layer closure</u>	
Animals	Weight in grams	Animals	Weight in grams
1	2425	1	2375
2	2375	2	2250
3	2150	3	2200
4	2250	4	2150
5	2200	5	2175
6	2275	6	2225
7	2175		
Average	2264.22	Average	2220.83

Seven animals from two layer group and six animals from one layer group were sacrificed one tenth post operative to see adhesions and appearance of peritoneum and they were also used to measure tensile strength of healing incision. Tensile strength was measured by tensionometer. In seven animals of two layer group average tensile strength was 2264.22 grams while average tensile strength in one layer group was 2220.83 grams. Thus the difference in the tensile strength in two groups was very minimal which is not statistically significant. Hence closure of peritoneum has little relevance with strength of healing incision.

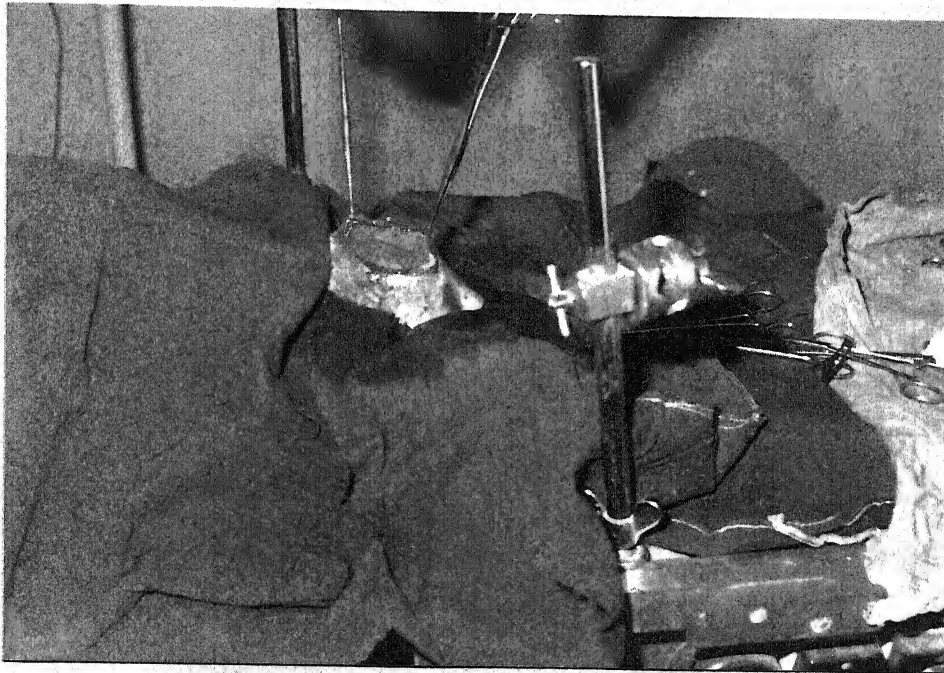
The rest of the animals of both groups i.e. seven animals from each group were followed for three months to observe late post operative complications of laparotomy.

Table No.6

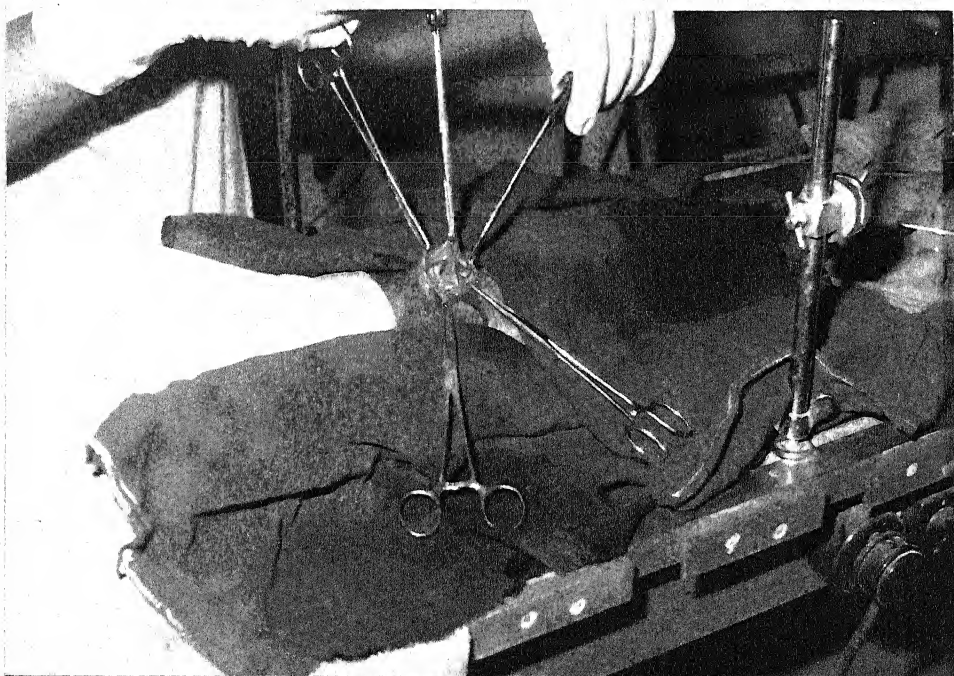
Showing incidence of incisional hernia and other late post-operative complications in two groups of animals.

Group	Incisional hernia	Others
Two layer closure	Nil	Nil
One layer closure	Nil	Nil

In no groups of animals incisional hernia or other late post-operative complications developed.



Photograph showing appearance of peritoneum
on reopening of abdomen on 10th day in animals
in which peritoneum was left open



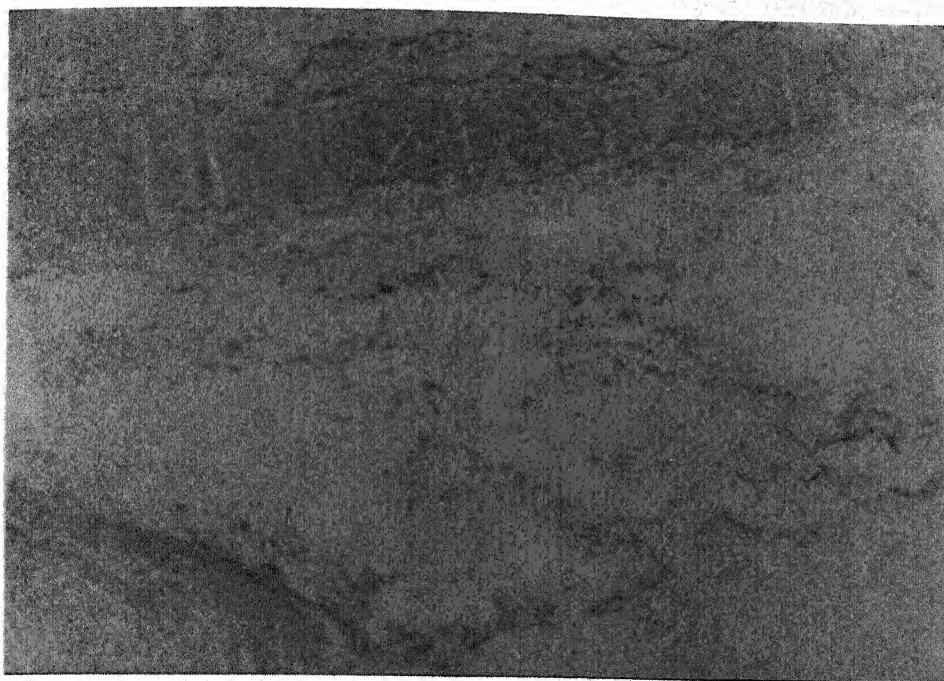
Photograph showing peritoneal adhesions
with small intestine in animals in which
peritoneum was sutured



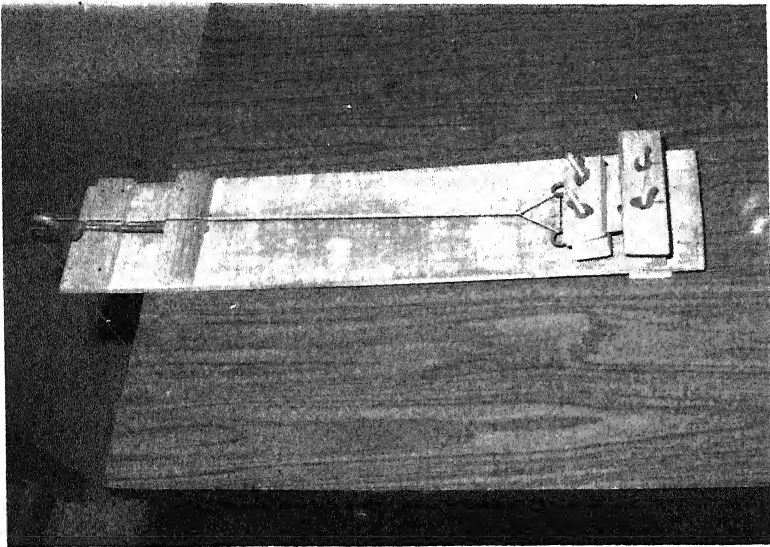
Photograph showing appearance of peritoneum
on re-opening of abdomen on 10th day in
animals in which peritoneum was closed



Photograph showing block of tissue of
abdominal wall taken for tensiometry
and histological examination



Photograph showing microscopic picture (low power)
of healed peritoneum in animals in which peritoneum
was not sutured



Photograph of Tensiometer used for
measuring tensile strength of healing scar

DISCUSSION

DISCUSSION

Post-laparotomy abdominal complications remain important surgical problem. Burst abdomen, adhesions and incisional hernias are most important abdominal complications which give lots of mortality and morbidity to the patients.

From the earlier days of abdominal surgery surgeons became familiar with different abdominal complications. Pathologists and surgeons tried to study the etiopathological basis of these complications. They reached to the opinion that method of closing the laparotomy wound is one of the important factors in preventing the abdominal complications.

Keeping this view in mind different techniques of closure of laparotomy wound evolved up in due course of time. Among these layered closure of abdomen in which peritoneum is closed separately in one layer and anterior rectus sheath is closed in another layer and mass closure of abdomen are important techniques. But these techniques could not prevent the abdominal complications, even though surgeons went on suturing peritoneum and are still suturing to restore the normal anatomy. This study was conducted employing a new

technique of laparotomy wound closure in experimental animals in which peritoneum was not sutured to determine the relevance of peritoneal closure from the point of view of peritoneal healing, scar tissue strength, adhesions and incisional hernias.

In our study peritoneal healing was studied in twelve animals who were sacrificed on tenth post operative day to see the appearance of peritoneum where it was incised and left open. In both group of animals smooth glistening membrane was found along the incision line. This clearly suggests that the peritoneal closure is not required for its subsequent healing. This observation of ours is strongly supported by the studies of Hertzler (1919), Robbin (1949), Ellis (1966). These workers studied the peritoneal healing in experimental animals and showed that peritoneum does not heal from edges, a defect in parietal peritoneum irrespective of its size becomes endothelialized simultaneously and not gradually from border as in epidermitization of skin.

In our study histology of healed peritoneum was studied on the tenth post operative day and we found that healing was complete with in ten days showing normal histology of peritoneum that is a single layer of flattened mesothelial cells which covers a layer of connective tissue.

This work is supported by Hubbard T.B. and others (1967) who studied the pathology of peritoneal repair on experimental animals and found that in 4-6 days peritoneal defects healed to a surface indistinguishable from normal peritoneum in histology. Harold Ellis and Robert Heddle (1977) found the same histology in one and two layer closure.

In our experimental study six animals of each group were studied for adhesions. In one layer group two animals (33.33%) developed adhesions while in two layer group three animals (50%) developed adhesions. This shows that incidence of adhesions formation is more when peritoneum is closed. This finding was supported by Von Debowaki (1888), Franz (1902), Robbin Brunch wig and Foote (1949), Buchman, Thomas and Rhoads (1950), Rini (1952), Singleton (1952), Ulfelder and Guinby (1951), Trippi and Bacon (1952), Williams (1955), Ellis (1962) and R.C. Karipineni (1976). These workers reported in their work on experimental animals that defects of parietal peritoneum where peritoneum was not sutured healed with fewer adhesions than did the abdominal incisions in which peritoneum was sutured. This shows that deperitonealized surface per se is not the cause of adhesions. The cause of the adhesions formation are trauma of suturing the

peritoneum and foreign body reaction to suture material.

In our study tensile strength of healing incision (Scartissue) of animals of one layer closure was 2233.33 grams and of two layer closure group 2166.66 grams. Since tensile strength is almost equal in both the groups so closure of peritoneum has little relevance to the subsequent strength of laparotomy scar. Recent work by Karipineni (1978) Harold Ellis and Robert Heddlie (1977) records similar bursting (tensile) strength of abdominal incisions in dogs in which the wound was closed with or without peritoneal suture.

In our study six animals of both groups were watched for three months for incisional hernia. But no animals from either group developed incisional hernia. So our study reveals that there is no relevance of peritoneal closure with development of incisional hernia.

In our study we could also show that operation time can be saved by leaving the peritoneum open. Particular situation exists in which location of incision, the body built, condition of patients and depth of anaesthesia make closure of peritoneum awkward and difficult and hence much time is consumed in closing it.

Not only this, in fat, straining patients and in patients of intestinal obstruction peritoneal stitches tear through as fast as they are inserted. So much time can be saved by leaving peritoneum open with-out and deleterious effect.

Any manoeuvre in operative surgery increases the possibility of a mis step and a complication and prolongs the operation and the anaesthesia.

If peritoneum is purposely ignored and the surgeon is free to concentrate on a good approximation of the fascial planes, the conditions for the formation of a strong fascial scar are better satisfied as always it is better to do the important thing well than to do two things quasiwell.

SUMMARY AND CONCLUSION

S U M M A R Y A N D C O N C L U S I O N

The importance of closing the peritoneum in the abdominal incisions to prevent post-operative burst abdomen, hernias and adhesions is generally accepted. Yet, experimental data to support this is lacking.

Particular situation exists in which the location of incision, the body built of the patient and depth of anaesthesia make closure of the peritoneum awkward and add considerable time for closure of wound. In addition, it might interfere with juxta position of edges of the fascia.

Several authors have reported that routine purposeful omission of closure of the peritoneum does not have adverse effect on the healing of wound and post-operative complications. But still, most surgeons believe that peritoneum must be sutured in closure of an abdominal incision.

In our experimental study we have tested the relevance of the peritoneal closure in the healing of abdominal incisions in dogs from the point of view of wound strength, adhesions and incisional hernias.

In our study we took twenty seven dogs as experimental animals. In all cases abdomen was opened by right para median incision. Closure of verital laparotomy wound was randomized between a two layer technique of continuous catgut suture to peritoneum and anterior rectus sheath and a one layer technique in which peritoneal suture was omitted. Average operative time in two layer technique was twenty - two minutes and in one layer tech nique was sixteen minutes. In seven cases of two layer closures, there were adhesions in four cases (57.1%) and out of six animals of one layer closure adhesions were in two (33.33%) cases.

The naked eye appearance and histology of peritoneum in both groups was similar after healing. Histology was identical to normal histology of peritoneum.

The average tensile strength of two layer closure was 2264.22 gross while in one layer closure was 2260.83 grams.

In both groups of animals no late post operative complication e.g. incisional hernia developed.

We reached to the conclusion from our experimental study that there is no role of approximation of peritoneum in it's subsequence healing and healing of

laparotomy wound and it's strength.

Incidence of adhesion formation is also reduced by leaving peritoneum unsutured. So complications like intestinal obstruction due to adhesions can be minimised. Similarly there is no role of peritoneal closure in preventing incisional hernia and enough operative time, particularly in emergency surgery where time factor is very important, can be saved by leaving peritoneum unsutured.

We can draw the inference from our study that careful approximation of fascial edges is the key factor in the repair of abdominal incisions. Concentration on maintaining a meticulous, accurate and strong fascial approximation will result in a safer, faster and equally strong and less frustrating closure of the abdominal incisions.

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